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Motion of an active particle in linear concentration gradients[1]
PRATHMESH VINZE, AKASH CHOUDHARY, PUSHPAVANAM SUBRAMANIAM, Department of Chemical Engineering, Indian Institute of Technology, Chennai, TN 600036, India — Janus particles are self-propelling bodies which generate local concentration gradients in a thin layer (δ) compared to the size (a) of the particle($\delta \ll a$). Chemical assymetry along the surface is essential to generate chemical gradients. This generated concentration gradient gives rise to diffusioosmotic flows in the thin layer which is equivalent to a slip when seen from far, resulting in swimming of the particle even without any external concentration gradient.In realistic situations Janus particles can be in a fluid with concentration gradients. Therefore, in this work, we theoretically study the effect of external linear concentration gradient(electrolytic and non-electrolytic solutes) on Janus particle. The external gradient gives rise to a competition between the local concentration gradient and the external concentration gradient. We show that it can be captured by a non-dimensional activity number.The framework is general for any arbritrary angle β between the direction of concentration gradient and the axis of self- propulsion. We see, for $\beta = 0$, only the translational velocity changes, subject to a change in strength of external concentration gradient. However, for other angles, the Janus particle undergoes rotation.

[1]Department of Chemical Engineering, Indian Institute of Technology, Chennai, TN 600036, India

Prathmesh Vinze
Department of Chemical Engineering, Indian Institute of Technology, Chennai, TN 600036, India

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